Mining is like a search-and-destroy mission.
Stewart L. Udall
***1976—Agenda for Tomorrow*, 1968**

MINING

Controversial Canadian Regs

After 10 years of research and debate, Canada is on the verge of adopting new regulations that limit the amount of metals and suspended solids contained in the effluent that mines release into waterways. But the proposed regulations have raised the hackles of environmental groups and mining companies alike. Environmentalists say the new rules offer scant improvement over those that have been in place for 24 years. And industry representatives warn that some facets of the rules will impose economic hardships without improving water quality.

Modern mining techniques require millions of gallons of water, mixed with chemical "lixiviants," to strip specific metals from pulverized ore. Besides the target metals, however, this process also releases other metals such as arsenic, lead, and zinc. Before returning water to the environment, mining operations must remove these metals, usually by adding lime and allowing the metals to settle in dammed areas. Like most Western governments, Canada regulates the amount of metal remaining in treated water that can be released into waterways.

Environmentalists were disappointed to learn that the proposed limits for dissolved arsenic, copper, lead, nickel, and zinc are no different from those adopted in 1977. "You can have standards that are five times stronger than is proposed and that are technically and economically feasible and achievable," says Burkhard Mausberg, executive director of the Canadian Environmental Defence Fund. No limits were set at all for mercury or cadmium, both of which have been officially designated as "toxic" under the Canadian Environmental Protection Act.

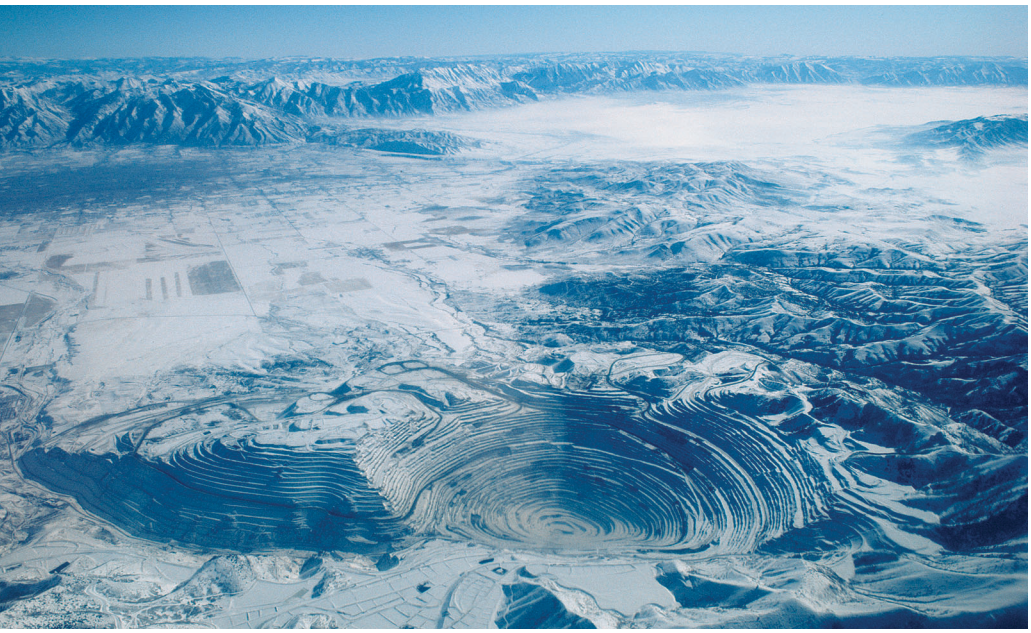
The limits in the proposed regulations are unchanged from existing law, says Chris Doiron, a senior specialist for standards development for Environment Canada, because "the physical mechanical separations and the technology for achieving that haven't changed substantially for some of the metals over the course of the past twenty years." But the proposed metal mining effluent regulations, which will fall under the federal Fisheries Act, offer significantly more environmental protection than the 1977 law, he says. The proposed regulations were developed through a consultation process involving representatives from industry, environmental groups, aboriginal groups, and federal and provincial departments.

The new rules will cover all of Canada's 93 metal mines, two-thirds of which are exempt from the current law. For the first time they set a limit for cyanide (1.0 ppm), which is used as a lixiviant in gold mining. They require that effluent pass an acute lethality test on juvenile trout. (A second test—on *Daphnia magna*, a species of water flea—is also required, but only for data collection.) They lower the allowable total suspended solids limit from 25 ppm to 15 ppm. And they require that mines conduct environmental effect monitoring.

"There have been incredible increases in technology since 1977 in the ability to measure smaller, minute amounts of dissolved metals," says Catherine Coumans, research coordinator for the environmental group MiningWatch Canada. She says that's why many countries are able to set limits lower than Canada's proposed limits. For example, Sweden, Ghana, South Africa, Vietnam, Indonesia, and Japan have limits that are half or less of the Canadian standard for lead; the United States and Sweden have limits that are one-half or less the Canadian limit for copper.

Industry representatives readily accept renewal of the current metal limits, but the lower total suspended solids limit is another matter, says Leonard Surges, manager of environment, safety, and health for Noranda, one of Canada's largest mining and smelting companies. Spring and fall runoff in mountainous areas is already laden with sediment, and that water must be stored and allowed to settle much longer than under current limits. That means building bigger dams. "The cost to do something which may not significantly reduce discharges to the environment, which may in fact increase the risks [for instance, a larger dam may be more likely to fail], which probably won't have a measurable benefit, can really be quite substantial," Surges says.

The trout lethality test requirement also concerns mining companies, says Elizabeth Gardiner, vice president of technical affairs for the Mining Association of Canada, because the industry hasn't found a way to consistently identify what in a given batch of effluent might cause the lethality test to fail. "What [the methodology] doesn't do is always provide a consistent answer as to why your effluent may be toxic," she says. But that's the whole point of the test, says Coumans, who adds, "It can be quite difficult to see how metals complex and what their actual effect is in biota. Even if you get all the individual limits right, you can still get mixes and toxic mixes that are going to have a biological impact." **–Scott Field**



No middle ground in mining. Proposed Canadian mining regulations have pleased neither environmentalists, who view them as weak, nor mining industry representatives, who feel they will impose undue economic burdens.

PhotoDisc

HERBAL MEDICINE

Food Research Bears Fruit

Plenty of foods can cause adverse health effects, such as food laden with animal fats, which can result in clogged blood vessels, or sweets, which can destroy your teeth. But researchers from around the world are also finding that there are foods that may protect you against disease. They discussed some of their findings at the International Chemical Congress of Pacific Basin Societies (Pacifichem 2000), held 14–19 December 2000 in Honolulu, Hawaii.

Jonel Saludes, an assistant professor of chemistry at the University of San Agustin in Iloilo City, the Philippines, reported that extract from the leaf of the noni plant, which grows abundantly in Hawaii, Australia, and the Philippines, contains chemicals that effectively kill even resistant strains of tuberculosis bacteria *in vitro*. "We found that this extract and the compounds obtained from it are as effective against *Mycobacterium tuberculosis* as some of the drugs currently used for the treatment of tuberculosis," said Saludes.

Noni, also known as Indian mulberry or cheesefruit, has been a staple of native healers, Saludes said. He noted that the extract compounds have yet to be tested in animals or human beings.

Japanese researchers reported that avocado may protect the liver, if results in animals translate to humans. Hirokazu Kawagishi, a professor of applied biological chemistry at Shizuoka University, fed laboratory rats diets containing avocado and 22 other fruits over a two-week period. Then the rats were given feed containing D-galactosamine, a compound that kills liver cells. Kawagishi said that aside from avocado, fruits that proved to provide the most protection against liver damage were watermelon, papaya, lychee, kiwi, Japanese plums, grapefruit, figs, and cherries.

Another Japanese team found that the pungent, green condiment wasabi, often used to flavor sushi and other foods, contains components that can prevent bacteria from creating conditions that lead to tooth decay. Laboratory studies showed that compounds in wasabi, made from a plant in the cruciferous family, prevent the bacterium that causes tooth decay, *Streptococcus mutans*, from adhering to the teeth. The researchers believe multiple chemicals in the plant may have a synergistic protective effect.

Researcher Hideki Masuda, director of the Material Research and Development Laboratories at Ogawa & Company in Chiba, suggested that eating a small amount of wasabi each day could prevent tooth decay. "My ultimate goal is that someday the ingredients in wasabi will be put into toothpaste so people can more easily get protection against tooth decay," he said.

Meanwhile, in Canada, a combination of animal and laboratory studies suggest that moderate drinking of beer, especially a glass of stout, might help protect a person against developing cataracts. "Rich, dark ales and stout like Guinness contain a lot of antioxidants, and antioxidants appear to prevent cataract development," said John Trevithick, a professor of biochemistry at the University of Western Ontario in London.

Trevithick demonstrated that in animal models, antioxidants could reduce the formation of cataracts by as much as 50%. In experiments with rat eye lenses, Trevithick found that antioxidants that act similarly to those in beer protect mitochondria in lens cells. Damaged mitochondria in lens cells can lead to an increased incidence of cataracts.

In another presentation, U.S. researchers reported that women whose lifelong diet is rich in soy products appear to have a reduced risk of breast cancer, bolstering earlier findings on this food–disease relationship. After analyzing tests on Chinese women, the scientists said they can track the impact of soy in the diet: "Women with the highest levels of soy in their diet have about a fifty percent decrease in the risk of breast cancer compared to those with the lowest levels," said Adrian Franke, a research specialist at Honolulu's Cancer Research Center of Hawaii. Franke and colleagues at Vanderbilt University in Nashville, Tennessee, measured isoflavones in the urine of women in Shanghai, China, and found that those levels correlated well with soy intake, giving scientists a biomarker for soy consumption.

Such findings don't surprise William Fenical, an organic chemist at Scripps Institution of Oceanography in La Jolla, California. "We are just on the forefront of really knowing what the effect of foods are on our health," he said. **–Ed Susman**

Top to bottom: PhotoDisc; Photodisc; TartfEHP

Gold Turns Green

The world's largest gold processor, South Africa's Rand Refinery, announced in March 2001 that it had received ISO 14001 certification for both its smelter and its refinery (which produces up to 99.99% pure gold), making it the most ecologically friendly facility of its type.

Rand spokesman Paul Streng said scaling down the use of chemicals and reducing waste output by 20% will not only make processing more cost-efficient, but will also conserve nonrenewable resources and reduce possible risks to workers at the facility and to residents living nearby. Part of the waste reduction comes as a result of the installation of newly developed fume extraction fans and scrubbers, which clean the air emitted from the facility before it is released into the environment.

Sickening Soap Trade

Irish government health agencies have begun investigations into the manufacture, export, and sale of mercury soaps, which are marketed to African consumers in a number of countries, citing purported skin- and hair-lightening properties. Some brands of mercury soap have been found to contain 1–3% mercuric iodide. Prolonged use of these soaps can lead to kidney failure, neurologic disorders, and a number of cancers, as well as fetal damage in pregnant women.

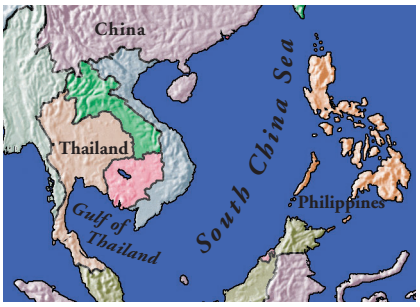
Though the sale of such soaps was banned by European Union countries over a decade ago, their manufacture remains legal. Irish manufacturer Killarney Enterprises exports the bulk of its output to Africa but also continues to sell the soaps in Ireland. Countries including South Africa, Zimbabwe, Nigeria, and Kenya have recently enacted bans against the products, which the World Health Organization states pose a "serious health hazard."

Smoking: Too Pricey for Teens

Some 3,000 U.S. teenagers become regular smokers each day. In a study of how raising cigarette prices could help reduce this number, researchers from the ImpacTeen program at the University of Illinois at Chicago and the University of Michigan determined that a 10% price hike decreased the odds that a teenager would start smoking by 10%. Says study researcher John Tauras, "Given that 90% of smokers start before they are 18, a hike in excise taxes appears to be an effective measure [to keep them from doing so]." This evidence comes as a number of state legislatures around the United States move to increase cigarette excise taxes.

MARINE SCIENCE

Sea Change in South China Sea



The South China Sea is one of the most biologically diverse marine ecosystems in the world. That's why the seven Asian nations that border it—Cambodia, China, Malaysia, Indonesia, Thailand, Vietnam, and the Philippines—agreed last year to a United Nations Environment Programme/Global Environment Facility (UNEP/GEF) project to reverse environmental degradation trends in the region. Pending final approval, the project would provide $32 million to improve environmental health in the South China Sea region. Half the $32 million is coming from the GEF, and the other half from participating countries and donors.

Rapid economic development and population growth have created significant ecological damage in coastal and marine areas of the seven South China Sea nations. "You've heard of the 'East Asian Miracle,' says Alfred Duda, senior advisor on international water issues for the GEF Secretariat. "A part of the East Asian Miracle is rapid development without the environmental aspects being accounted for, and the result is downstream degradation of water and other resources."

At least 270 million people now live along the coastlines of the seven nations, and the coastal population is expected to double over the next 30 years. The primary environmental threats in the South China Sea include mangrove destruction, sewage pollution, exploitive fishing practices, coral reef degradation, and damage to sea grasses and wetlands.

Almost 70% of the region's mangrove forests have disappeared in the past 50 years due to destructive shrimp farming practices, overlogging, and increased development and tourism, says Hugh Kirkman, coordinator of marine and coastal matters for the East Asian Seas Regional Coordinating Unit, the secretariat of the Coordinating Body of the Seas of East Asia. Large-scale disappearance of coastal mangrove forests has led to sediment erosion, water pollution, and a critical loss of nursery habitat for young fish.

Moreover, an estimated 60% of coral reefs in Southeast Asia have been severely degraded or destroyed. In the countries there, some fishermen have used destructive practices to harvest reef fish, such as dropping dynamite and cyanide into the reefs.

Each participating nation will develop pilot programs and devise policy, legal, and institutional reforms to restore damaged resources and protect existing ones. A steering committee will choose three demonstration sites at each of three major habitats: mangrove, coral reef, and sea grass. These sites will explore methods of managing habitats, reducing pollution, and improving or reducing fishing practices that damage the environment. Eventually, information from the pilot projects could be used to establish national legislation to protect coastal and marine resources. But each nation will identify what reforms are needed, and then will propose solutions by adopting a strategic action program. "Not all nations will agree on doing things a uniform way," says Duda.

Individual governments could eventually choose to protect resources by enacting tougher zoning, performance, and environmental regulations in coastal and marine areas, says Duda. For example, he says, "People could be required to operate shrimp farms further up in a coastal basin, where there would be some extra costs because you'd have to pump salt water from the estuary up the hill. But in this way, the shrimp farm would not interfere with mangroves."

Nations might also decide to apply an additional fee for sewage treatment in densely populated areas. These fees could be used to build new or improved sewage treatment plants. "Then clean water can nourish the coastal zone instead of the sewage-laden water that causes disease downstream and pollution affecting biodiversity and fisheries," says Duda.

In 2000, the GEF council approved the first stage of the project. Now UNEP is working out the final details with each country. A revised, completed project document could receive final GEF approval by spring of 2002, says Duda. **–John Tibbetts**

AWARDS

2001 Goldman Prize

The Goldman Environmental Prize is awarded annually to environmental grassroots heroes from around the world. At $125,000, the Goldman Prize is the world's largest award for environmental activists. Its recipients have taken on a diverse range of issues, from stopping toxic industries in communities to helping indigenous peoples preserve their environments and traditional ways of life. The prize money allows the winners to continue their work and expand public awareness of environmental crises.

This year's winners are Jane Akre and Steve Wilson from North America, Eugène Rutagarama from Africa, Oscar Olivera from South America, Giorgos Catsadorakis and Myrsini Malakou from Europe, Yosepha Alomang from Asia, and Bruno Van Peteghem from the Island Nations.

Akre and Wilson are television journalists who uncovered potential health risks of recombinant bovine growth hormone (rBGH), a genetically modified hormone injected into U.S. dairy cows to stimulate milk production. They reported on studies suggesting a possible link between rBGH and human breast, prostate, and colon cancers. They were fired from their jobs during the ensuing controversy.

Rutagarama worked to save the 355 mountain gorillas in the Virungas Mountains during Rwanda's war in the 1990s. The animals there make up over half of the existing mountain gorilla population. Rutagarama was instrumental in rebuilding the Rwandan national park system, and risked his life to get money and supplies to Congolese park rangers so they could continue their work with the gorillas.

Olivera is a Bolivian labor leader and an advocate for the universal right to affordable clean water. He led a coalition to fight increasing water rates after the city of Cochabamba sold its public water system to a U.S. corporation. The cost of water rose to as much as one-third of the income of many families. He also led protests and negotiations that resulted in the government decision to cancel the sale of the water system.

Malakou and Catsadorakis researched, organized, and advocated sustainable farming to restore crucial wetlands in the Préspa area near northwestern Greece, where over 260 species of birds migrate, winter, and breed, including the rare Dalmatian pelican. Their work resulted in the first transboundary preserve in the Balkans.

For more than 20 years, Alomang has fought environmental, economic, and cultural devastation to West Papua. She rallied her community to protest a gold and copper mine that was dumping tailings into local rivers, spreading pollutants in a virgin tropical rain forest. She also created a women's group dedicated to human rights, environmentalism, and preserving traditional culture.

Van Peteghem is working to protect one of the largest coral reefs in New Caledonia, an island nation in the South Pacific, from being mined by the nickel ore industry. He is leading an effort to have the reef put on UNESCO's World Heritage List of properties considered to be of "outstanding universal value."

"The winners this year illustrate how the environment is affected by wars, international business, economic policies, and the tendency to put short-term gains ahead of long-term solutions," says Richard N. Goldman, founder of the Goldman Environmental Prize. "They also illustrate how the courage and commitment of a single visionary individual can make a difference for generations to come." **–Lindsey A. Greene**

Corbis

USGS: Environment and Human Health

Although many people are aware of the occupational risks to mine workers (the industry has the highest fatal injury rate in the United States), the general public is less aware of indirect health effects posed to public health by mining. Only large-scale accidents alert the public to the fact that mining can pose serious risks to the health of people outside the industry. Recent examples of such accidents include a 1996 spill in the Philippines that released 1.5 million cubic meters of highly toxic water, killing large populations of coral and other marine life; a 1998 spill that threatened Spain's Doñana National Park with 5 million cubic meters of toxic waste; and mine spills in 2000 in Romania and Hungary that released high levels of cyanide and other toxicants into the Danube and other rivers.

One of the agencies looking at these risks is the U.S. Geological Survey (USGS), the sole scientific agency within the Department of the Interior. Serving primarily as an independent fact-finding agency, the USGS conducts multidisciplinary studies, often on a national scale, to provide both the public and government decision makers with information on environmental issues. The USGS has created a Web page, located at **http://www.usgs.gov/themes/environment_human_health.html**, that rounds up resources and information specifically dealing with the environment and human health, including many mining-related resources.

The site provides links to publications on mining-related health issues under the Publications heading. Agency research reports and program pages are available under the Projects and Programs heading. And information from meetings and conferences the agency is involved with, on issues ranging from health risks from drinking water to arsenic in the environment, is found under Meetings and Conferences.

The "Mercury Contamination from Historic Gold Mining in California" fact sheet under the Publications heading explains in a general fashion the gold mining processes used in California, how mercury was used in those processes until the 1960s, and how the mercury has contaminated the water and entered the food chain. Gold mining with mercury was mainly located in the northwestern areas of California, and it put more than 220 million pounds of mercury into the environment between 1850 and 1981.

Another fact page brings the effects of mining to the dinner table, detailing how walleye, a popular sport fish caught in Washington State's Lake Roosevelt, have been found to have higher concentrations of mercury than other sport fish. The page explains how the lake has become contaminated with mercury by smelters and mining activities discharging waste into the Columbia River, which feeds the lake, and its tributaries. It also advises consumers on the quantity of walleye it is safe to eat.

The Bear-Yuba Watersheds Interagency Abandoned Mine Lands Project link under the Reports and Programs heading takes the visitor to a site devoted to this interagency study, which is aimed at gathering information about mercury and methylmercury in the gold mining areas of California most heavily impacted by those substances. One of the study's goals is to determine if any of the sites on federal land in the area might be suitable for remediation. The site's home page features a map of the study area showing mining sites, bodies of water, and federal land holdings. Also provided are a study overview, photos, and an abstract of the 2001 Department of the Interior Conference on the Environment.

Also under the Reports and Programs heading is an overview and status report for all mercury studies being conducted by the USGS. Research under way includes studies on mining contributions to mercury load, materials flow, distinguishing between natural and anthropogenic sources, and atmospheric deposition patterns. **–Erin E. Dooley**

Diaper Genius

Disposable diapers are currently the third largest source of landfill waste, in part due to the petroleum-based gels they're packed with to absorb wetness. University of Wisconsin at Madison food scientist Srinivasan Damodaran has developed a way to reduce the 2.7 million tons of disposable diapers landfilled annually by using proteins derived from the nearly 30 million tons of fish scraps discarded by the global fishing industry each year.

Damodaran's solution is an odorless and inexpensive protein-based hydrogel that chemically binds water molecules. The gel can absorb up to 600 times its weight in water and rapidly biodegrades. In contrast, the petroleum-based gels currently in use absorb only 100 times their weight, and Damodaran says they "stand little chance of degrading over a reasonable time."

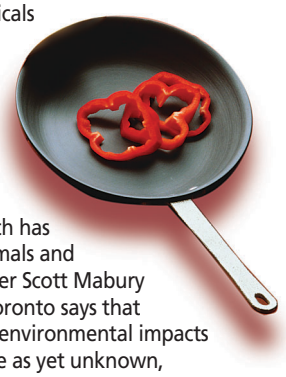
Clean Air for Europe

On 7 May 2001 the European Commission adopted the Clean Air for Europe program with the aim of developing an integrated plan for reducing air pollution in the European Union by 2004, when many union air quality directives will come up for revision. The program will provide the structure within which new regulations such as air quality standards and national emissions ceilings will be enacted.

Particulate matter and ground-level ozone will be two areas of special focus because of their effects on human health and the environment, the scientific complexities and uncertainties associated with them, and the need to rework current regulations so that concentrations of these pollutants can be reduced to safe levels.

Nonstick Toxicant

Canadian researchers have found that fluorinated polymers such as those used in nonstick cookware coatings like Teflon emit persistent and possibly harmful compounds when heated. The chemicals emitted include trace amounts of ozone-destroying chlorofluorocarbons, perfluorocarboxylates (which accumulate in animal tissues), and trifluoroacetic acid (which has unknown effects on animals and humans). Study researcher Scott Mabury from the University of Toronto says that although the long-term environmental impacts of trifluoroacetic acid are as yet unknown, high waterborne concentrations of the compound can be phytotoxic and take decades to degrade.



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